ICHOR Industry Day

Arlington, VA

December 05, 2003

DARPA Organization

Director, Tony Tether
Deputy Director, Bob Leheny

Information Exploitation
Ted Bially
Stephen Welby/Robert Tenney

- **Sensors**
- **Exploitation Systems**
- **Command & Control**

Tactical Technology
Art Morrish
Gary Graham

- **Air/Space/Land Platforms**
- **Unmanned Systems**
- **Space Operations**
- **Laser Systems**
- **Future Combat Systems**
- **Planning / Logistics**

Special Projects
Amy Alving
Joe Guerci

- **Chem/Bio Def Systems**
- **Counter Underground Facilities**
- **Space Sensors/Structures**
- **Navigation/Sensors/ Signal Processing**

Advanced Technology
Dave Honey
Larry Stotts

- **Assured C3ISR**
- **Maritime**
- **Early Entry/Special Forces**

Joint Unmanned Combat Air Systems
Mike Francis

- **UCAV (AF)**
- **UCAV (N)**
- **Autonomous Operations**

Defense Sciences
Steven Wax (Actg. Dir.)

- **Bio Warfare Defense Technologies**
- **Biology**
- **Materials & Devices**
- **Mathematics**

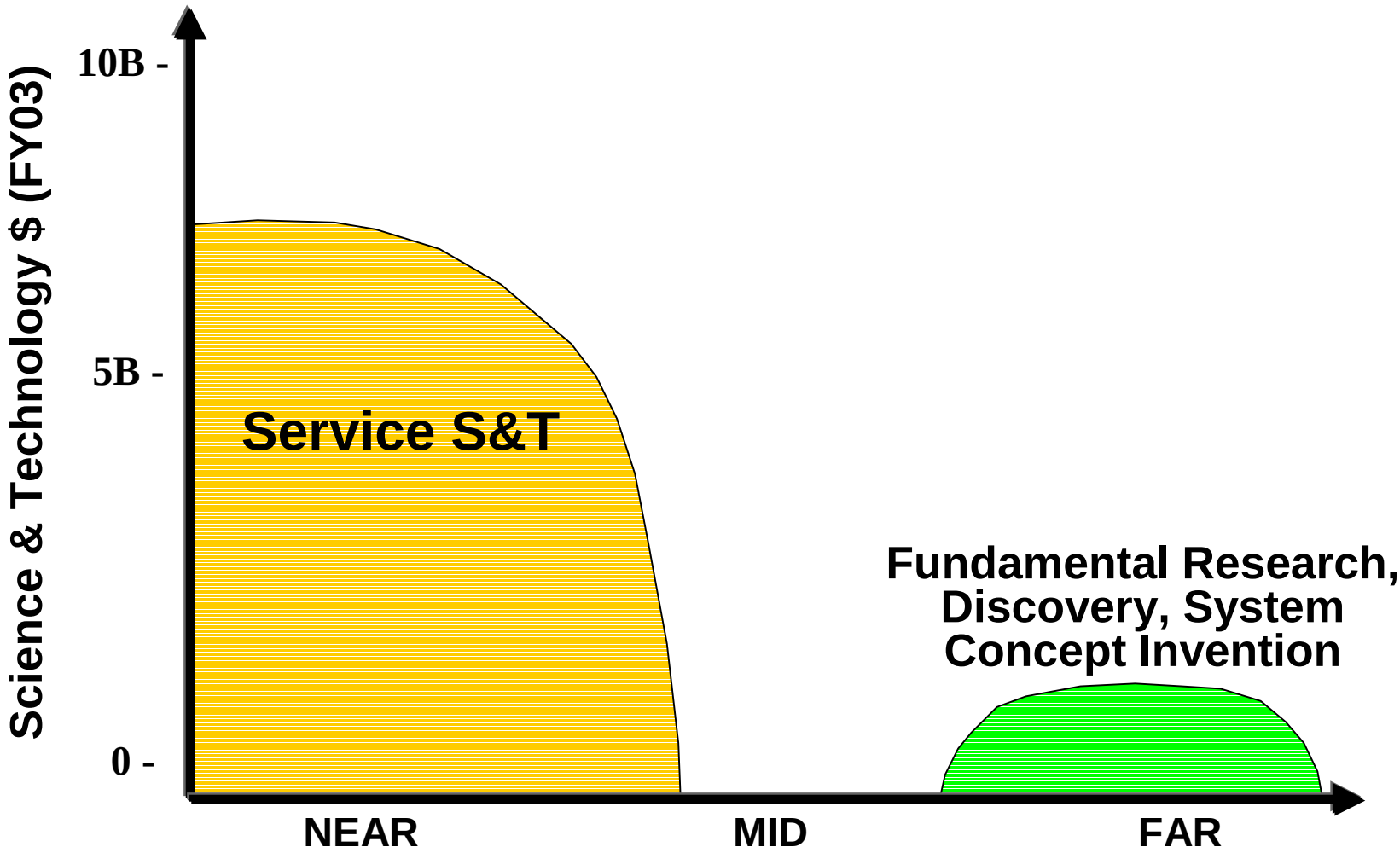
Information Processing Technology
Ron Brachman
Barbara Yoon

- **Cognitive Systems**
- **Computational - Perception**
- **Representation & Reasoning**
- **Learning**
- **Natural Communication**

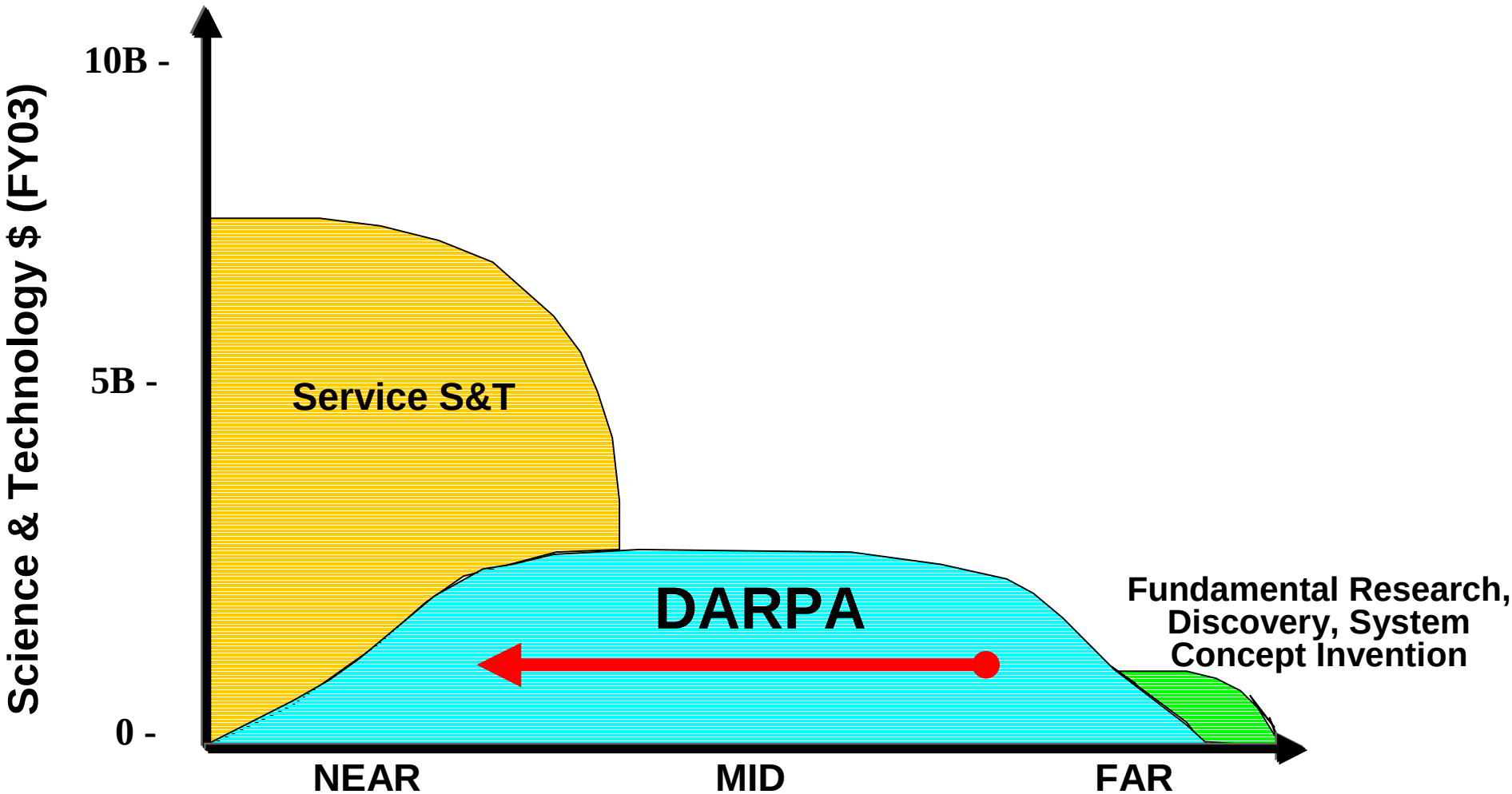
MicrosystemsTechnology
Zach Lemnios
John Zolper

- **Electronics**
- **Optoelectronics**
- **MEMS**
- **Combined Microsystems**

DARPA Role in Science and Technology



DARPA Role in Science and Technology

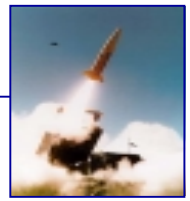


DARPA Accomplishments

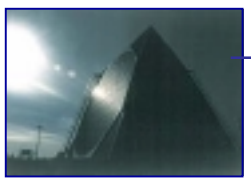
Saturn

Vela Hotel

M-16 Rifle



ATACMS



Ground Surveillance Radar

Arpanet

Stealth Fighter

JSTARS

Sea Shadow

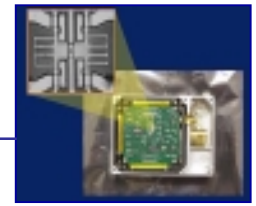
GPS

1960

1970

1980

UCAV



MEMS

TMR

MALD

JSF

Global Hawk

Uncooled IR

Predator

Taurus Launch Vehicle

BAT

2000

1990

Investments Today for Future Capabilities

- **Detection, Precision ID, Tracking, and Destruction of Elusive Surface Targets**
- **Characterization of Underground Structures**
- **Networked Manned & Unmanned Systems**
- **Robust, Secure Self-Forming Tactical Networks**
- **Cognitive Systems**
- **Assured Use of Space**
- **Bio Revolution**

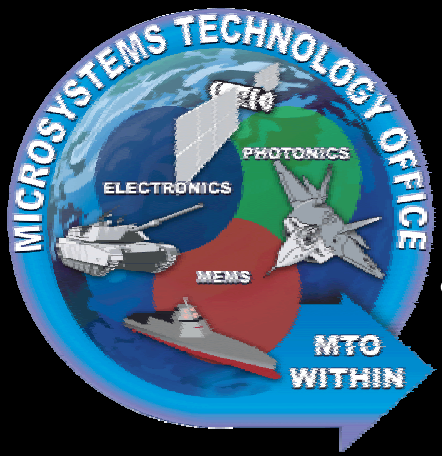
DARPA/MTO Mission

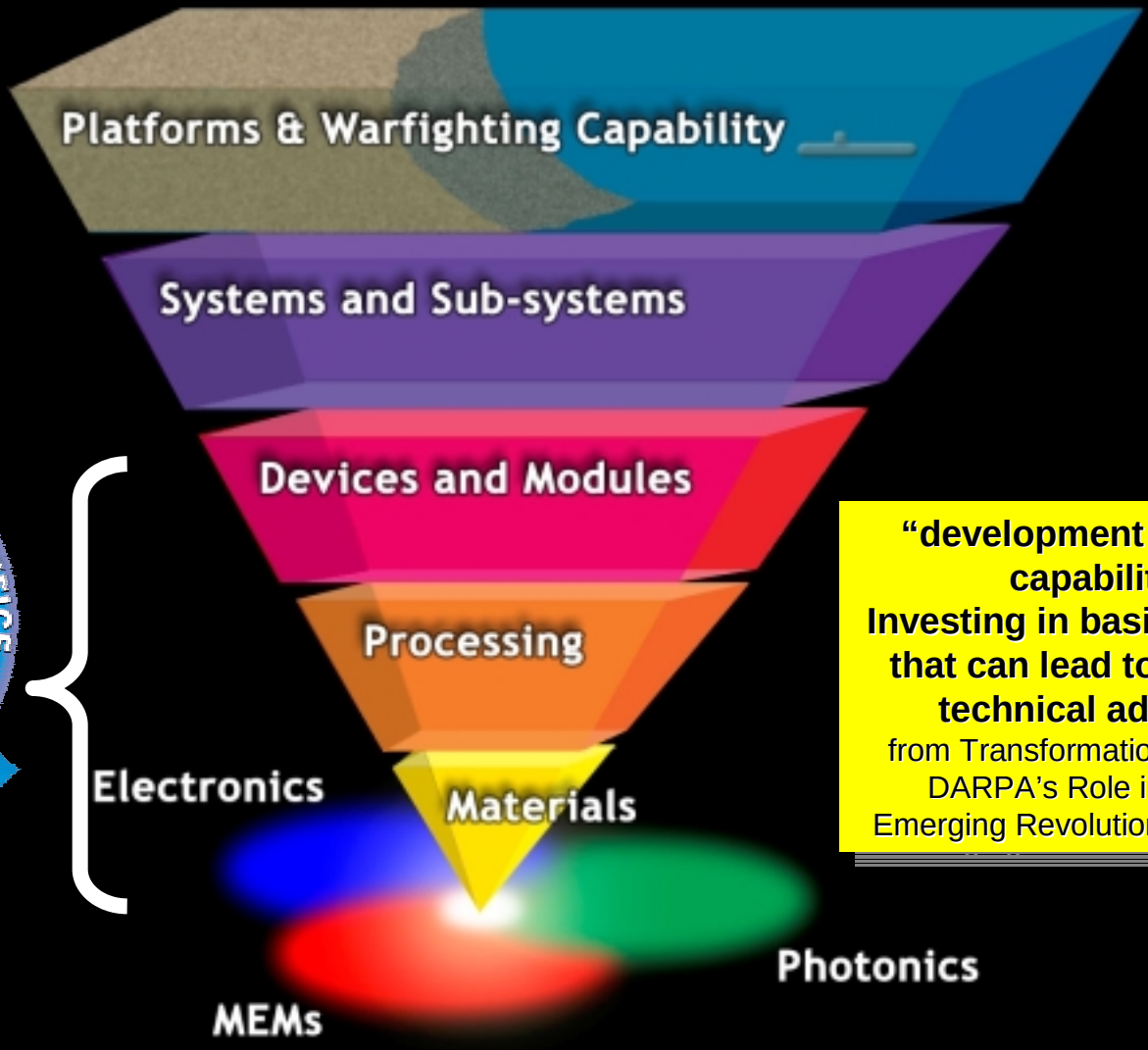
Develop, demonstrate and transition the key solid state technologies that enable dominant system concepts and capabilities for the Department of Defense

- **Pushing the limits of scaling and integration**
- **Microsystems for spectral exploitation and sensor dominance**
- **Systems that intelligently interact with the environment**
- **Tools that enable scaleable and affordable access to leading edge components**

DoD Access to Winning Microsystem Technology

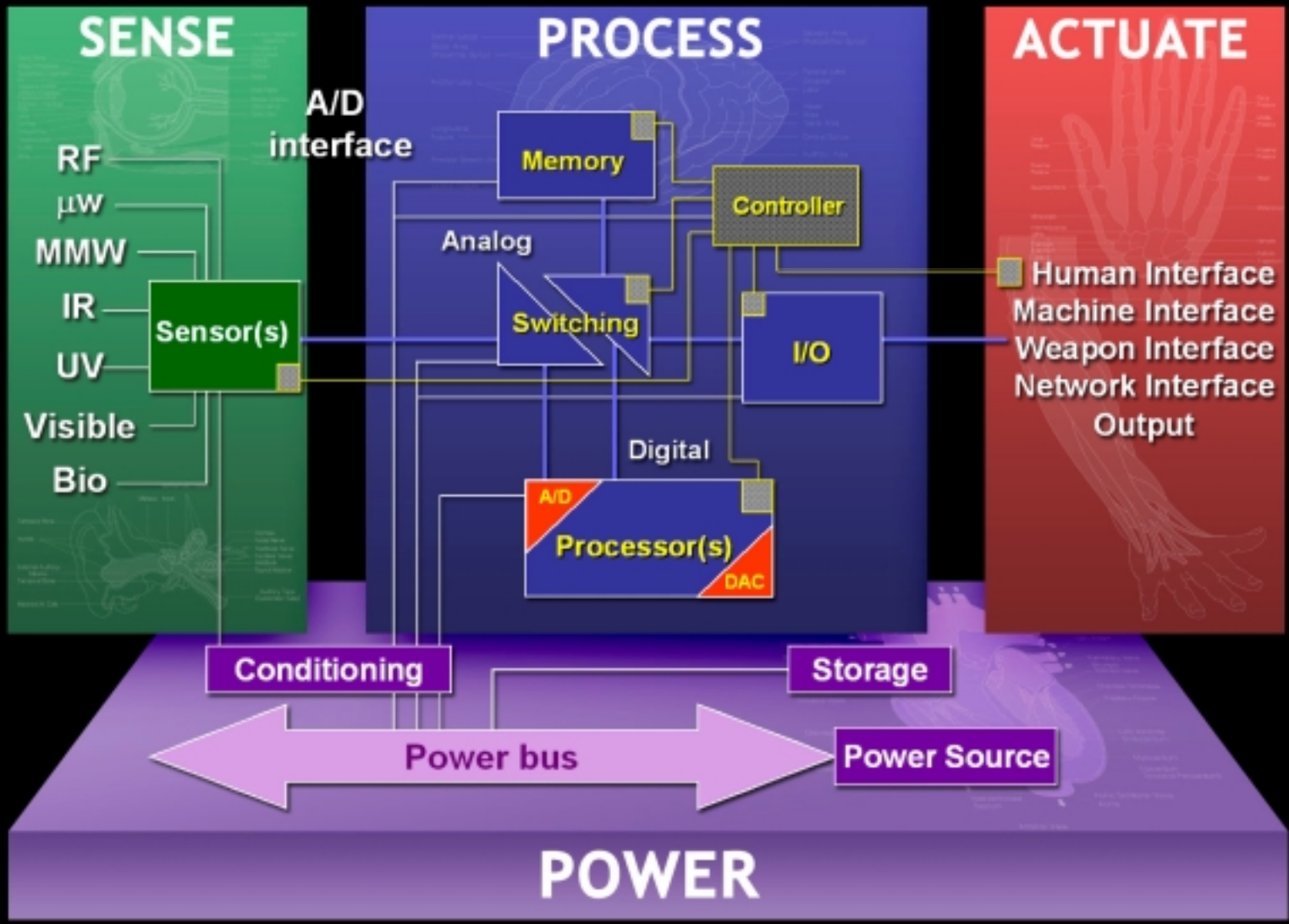
MTO Enables Platform Capability





"development of disruptive capabilities ….
Investing in basic technologies that can lead to fundamental technical advantages."
from Transformation and Transition: DARPA's Role in Fostering an Emerging Revolution in Military Affairs

MTO Intelligent Microsystem



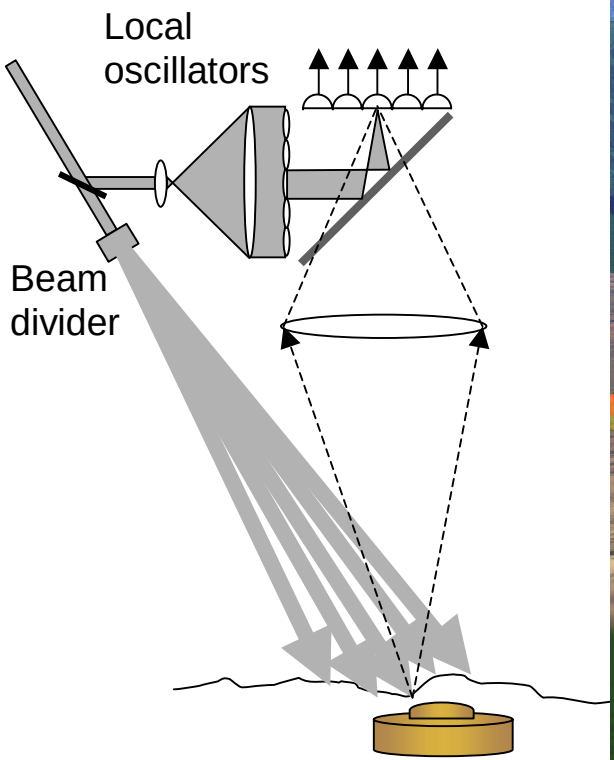
The DARPA Program Manager

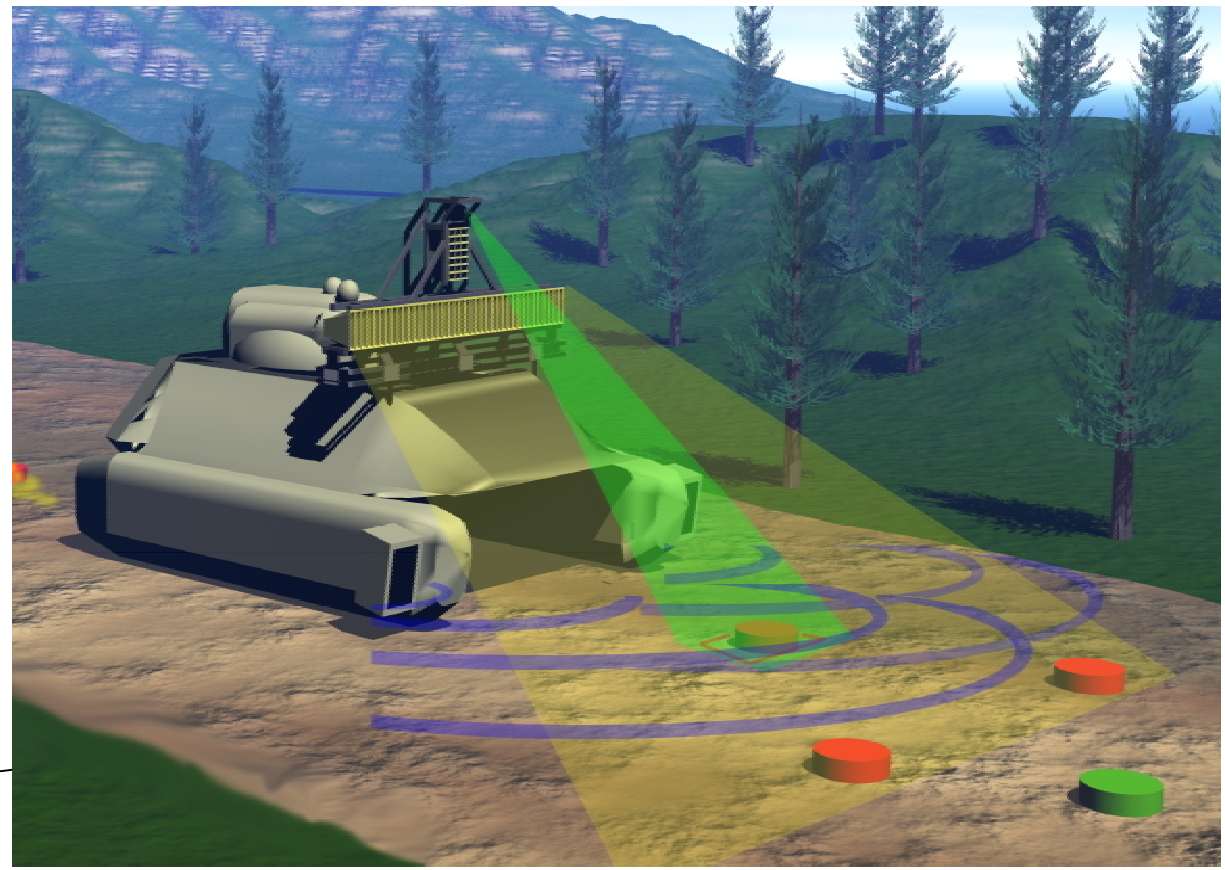
Chief Scientist, President, CTO, VC, Entrepreneur, Banker

- **Always looking for the next idea**
- **Creative and innovative**
- **Leader in the field**
- **Juggles ideas from industry, academia**
- **Always on the road**
- **Overloaded calendar**
- **Willing to take risk**
- **Articulate persuasive advocate of the idea**


ICHOR
IMAGING COHERENT OPTICAL LASER RADAR

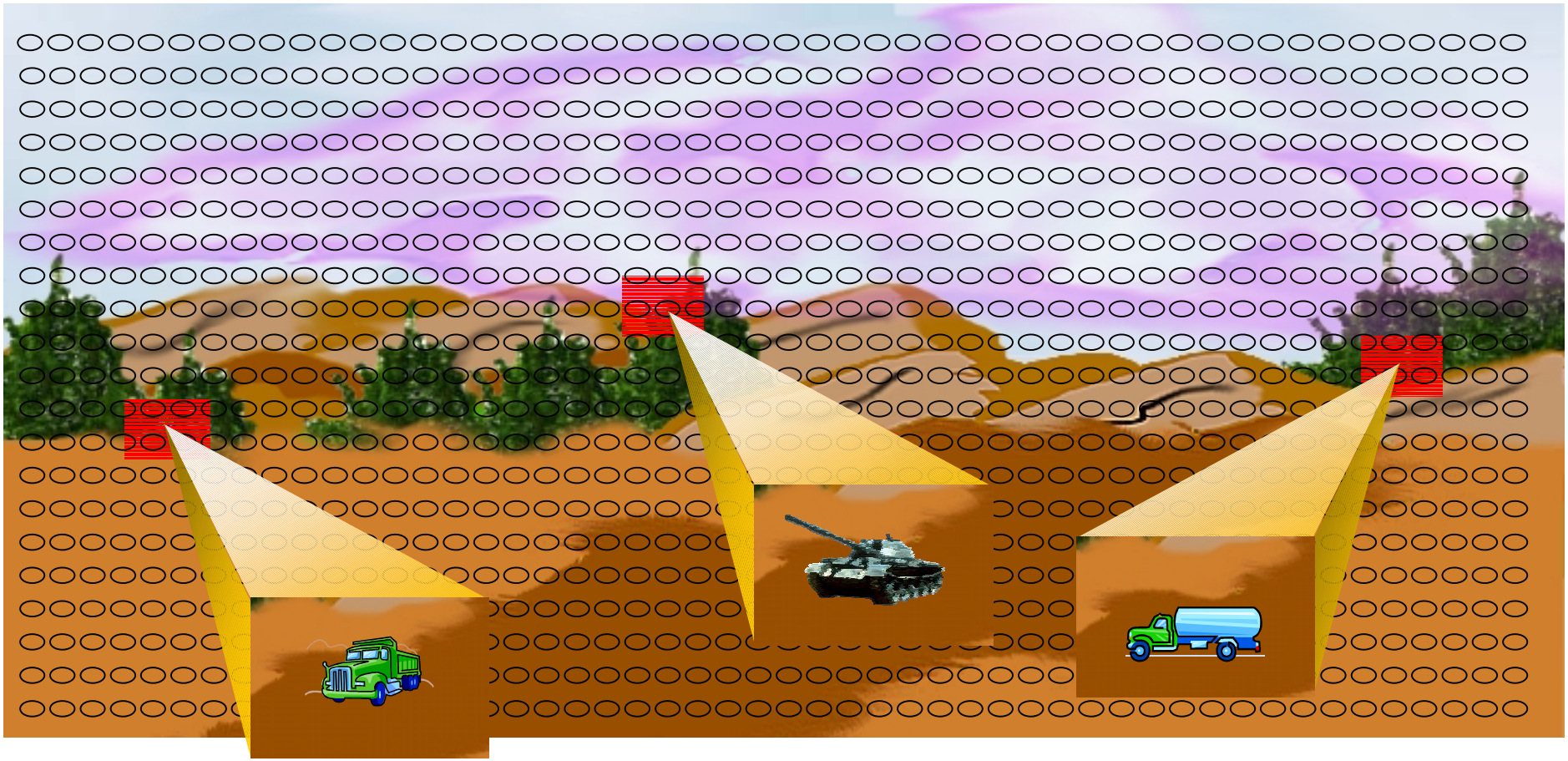
Mine Detection using ICHOR large arrays for Acoustic Laser Doppler Vibrometry



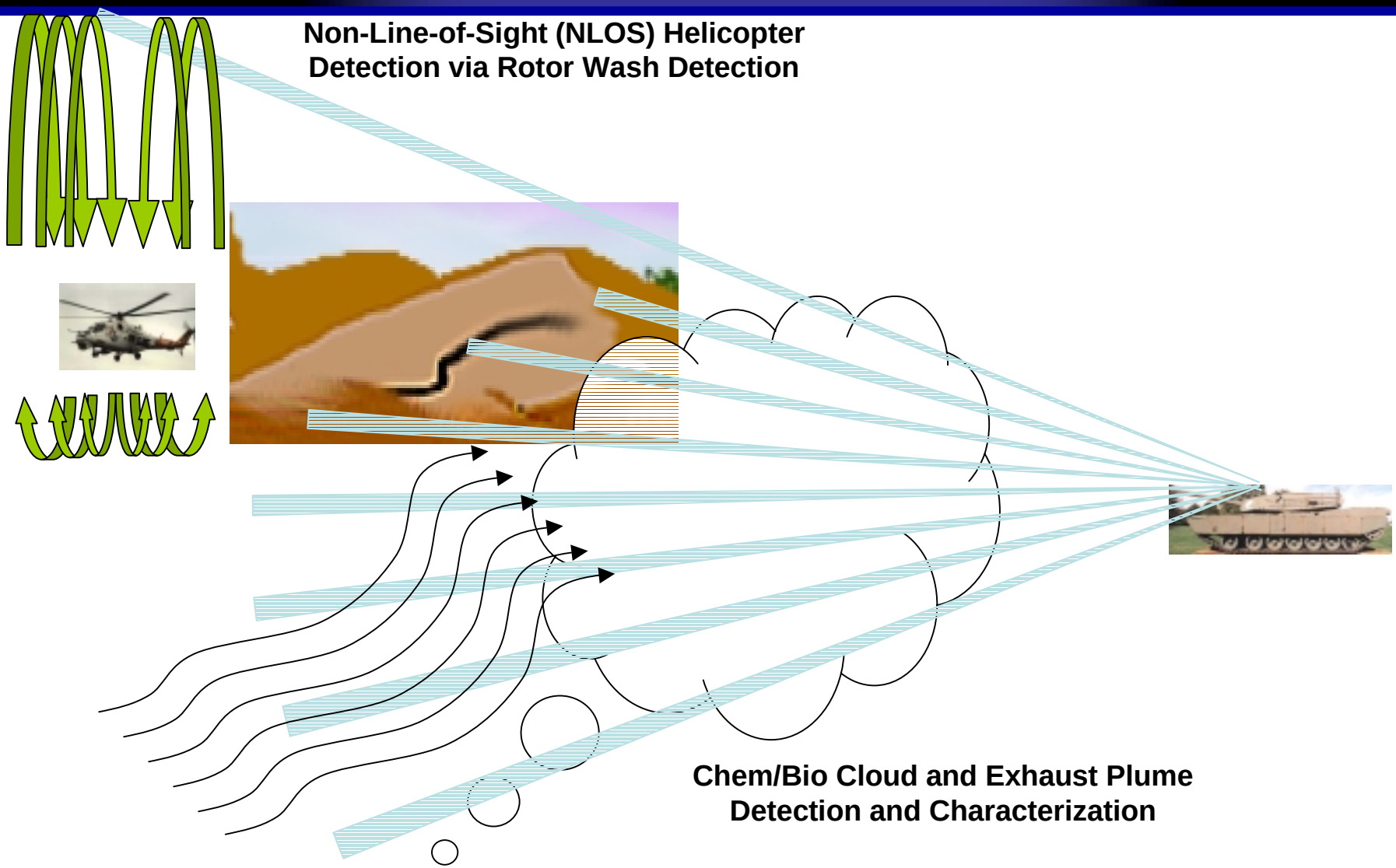


Current state of the art – single pixel, >40 sec per square meter
Five meter road swath, vehicle advance rate = 0.018 km/hr
With 1028 pixel ICHOR, vehicle advance up to **18 km/hour**
Insertion into FCS

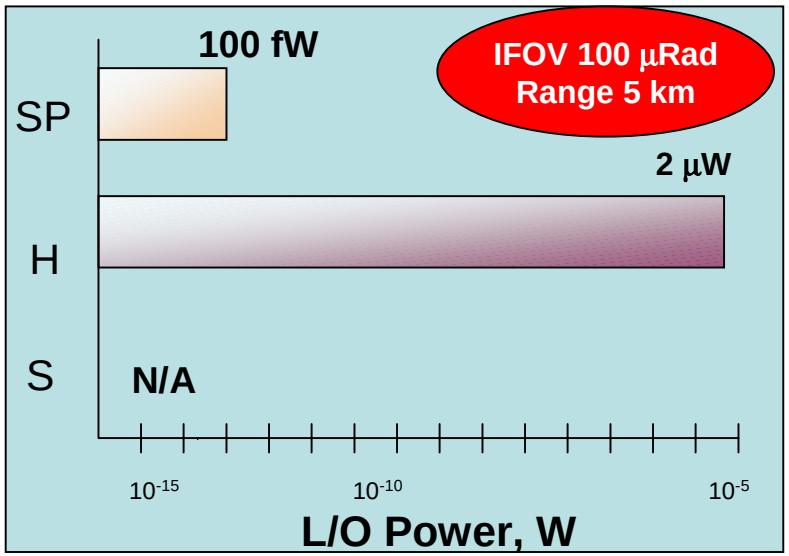
Threat Detection Using Large ICHOR Arrays

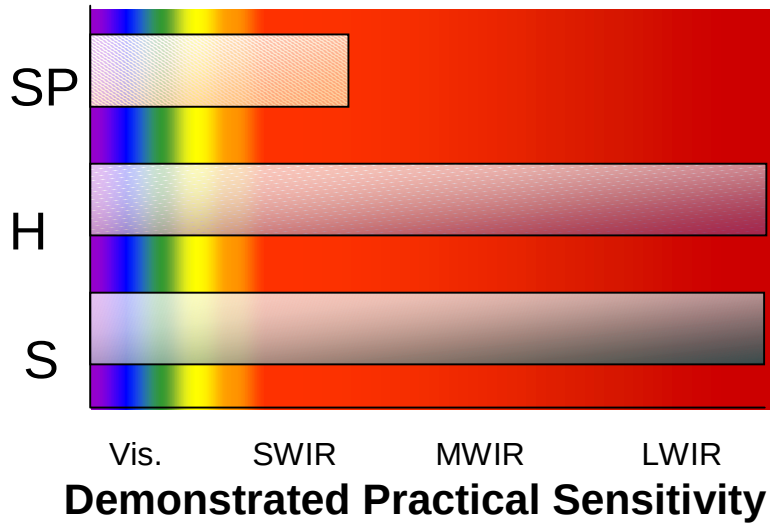


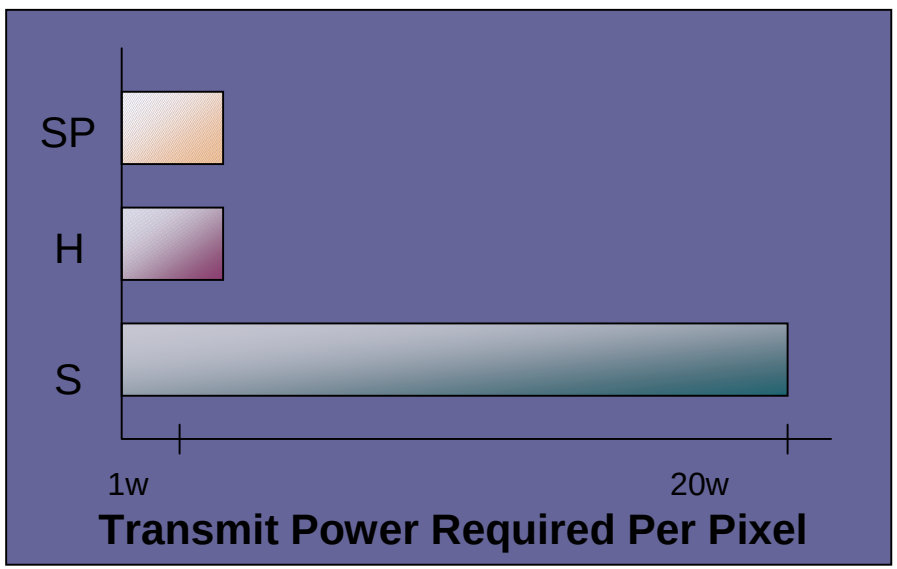
Atmospheric Sensing



Range Resolved Active Coherent Vibration Imaging







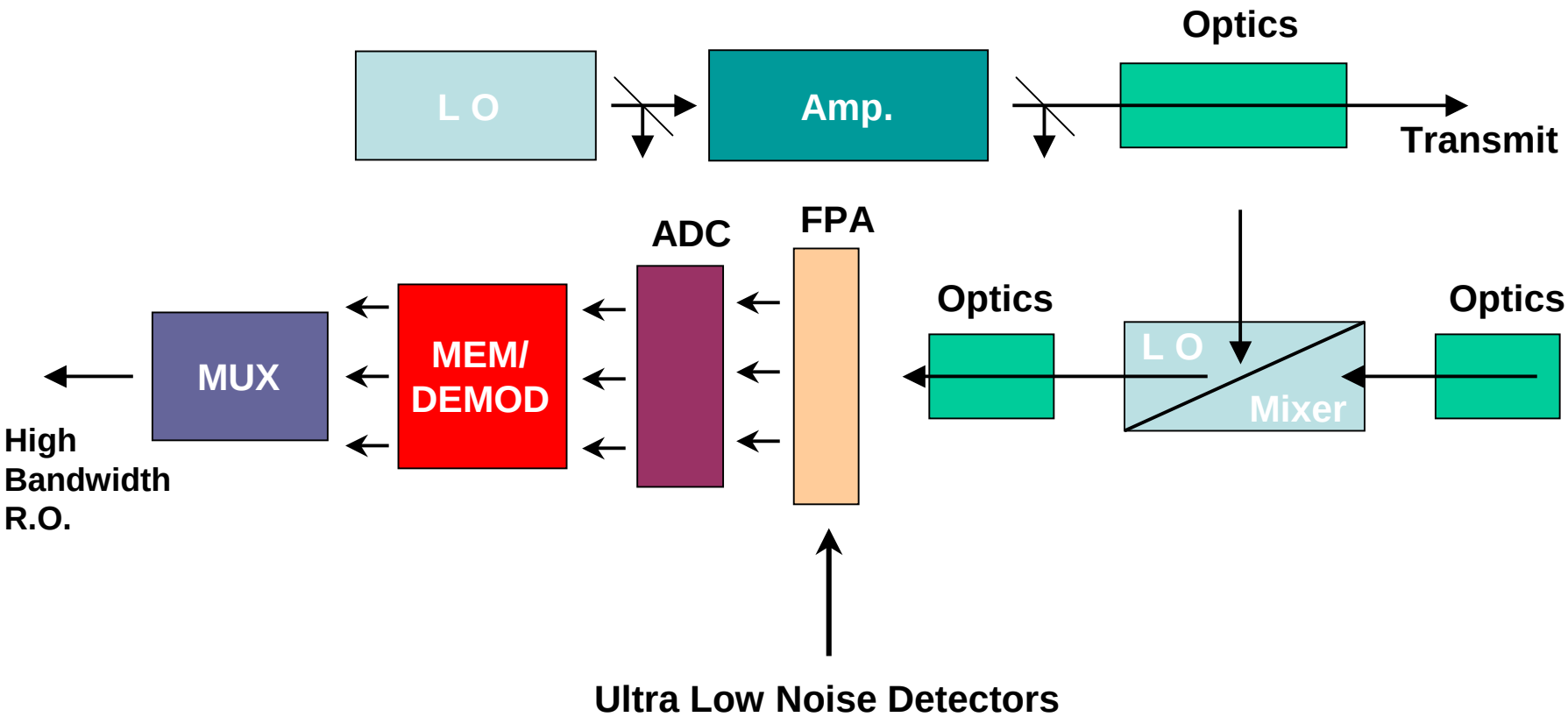
SP – Single Photon

H – Heterodyne

S – Speckle

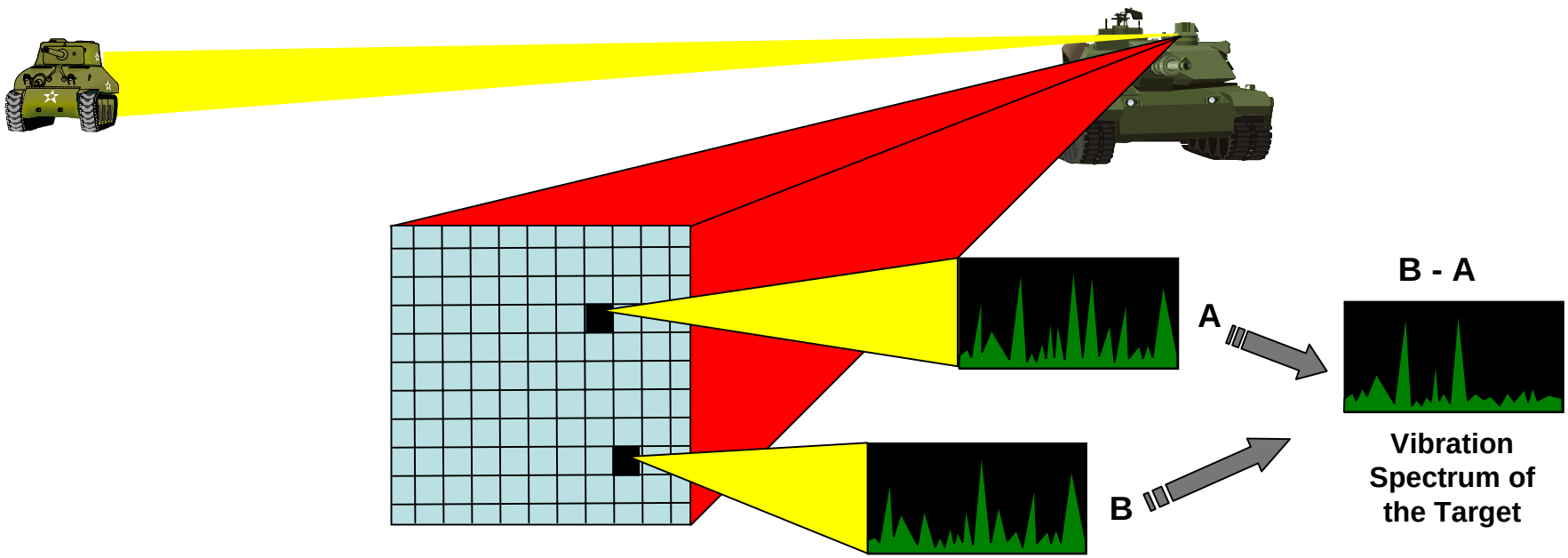
L/O – Local Oscillator

Basic Structure of Coherent High Speed Imager



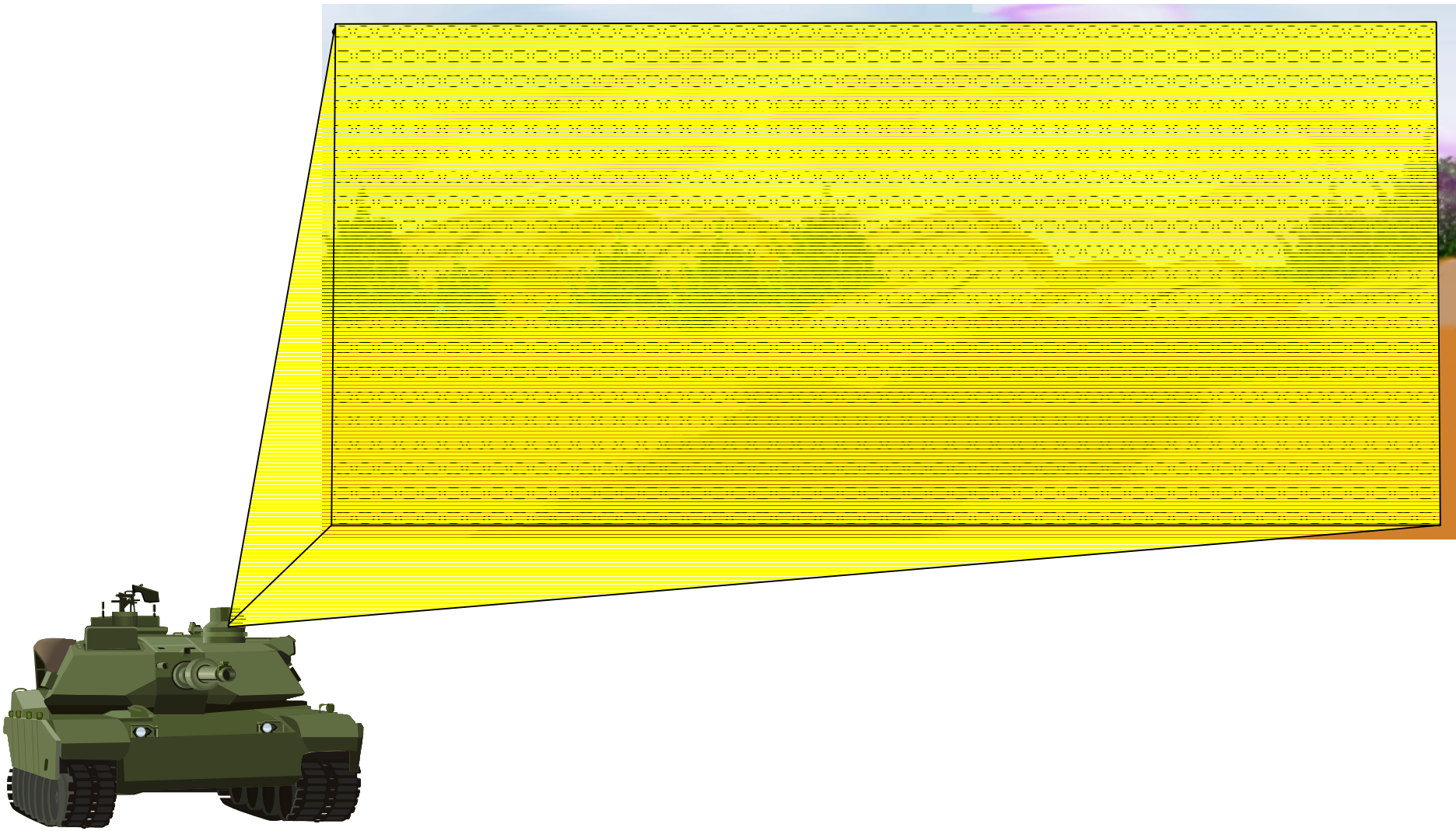
Program is basically technical development, that uses system demos to stay on track. The primary emphasis are; ultra low noise detectors (FPA, TIA & Pre-amp), high bandwidth cooperative processing on ROIC, and noise reducing optical design.

Common Mode Rejection

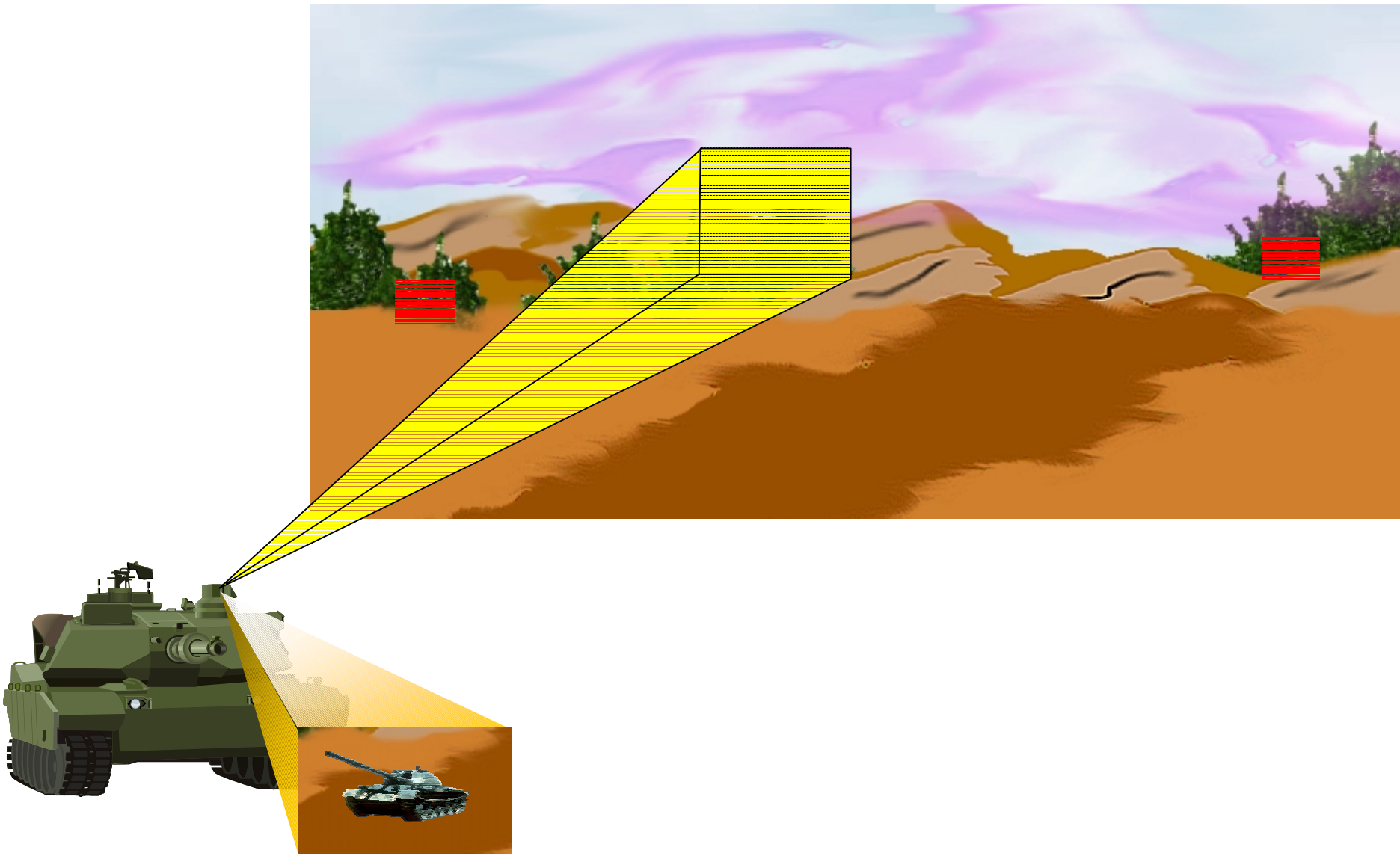


For a Sensor on a Vibrating Platform, Every Pixel Has the Platform's Vibrational Spectrum (Noise). Noise Reduction Techniques That Take Advantage of Simultaneous Detection at Many Pixels are Encouraged.

Threat Interrogation



Threat Interrogation



Performance Specifications

ICHOR Go/No-Go Criteria						
	Bandwidth	Pixel Count	Vibrational Frequencies	Vibrational Frequency Resolution	Velocity Sensitivity*	Low Displacement Limit
Phase I	100 MHz	≥100	DC-500 Hz	10 Hz	10 x σ	100 nm
Phase II	500 MHz	≥500	DC-1 KHz	5 Hz	3 x σ	10 nm
Phase III	1 GHz	≥1000	DC-2 KHz	1 Hz	σ	1 nm

* The vibrational sensitivity goal σ is listed in the classified Appendix.

Desired Proposal Discussion

The ideal proposal

- Pitches an integrated system meeting program sensitivity goals; supporting technology proposals will be considered if they offer leap-ahead technology.
- Contains sufficient modeling to demonstrate that the offeror will be able to meet the sensitivity goals of the program.
- Contains a coordinated plan to field test your system for each Phase of the program.

If two proposals have similar sensitivities and noise reduction, but one proposal gains sensitivity through cooling and the other through improved materials, the desired proposal would be the one that uses improved materials.

Integrated teams that contain a mix of universities, laboratories (government, FFRDC, etc.), component manufactures, and systems integrators, are encouraged.

BAA Timeline